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THE PHILIPPINE AGRICULTURIST

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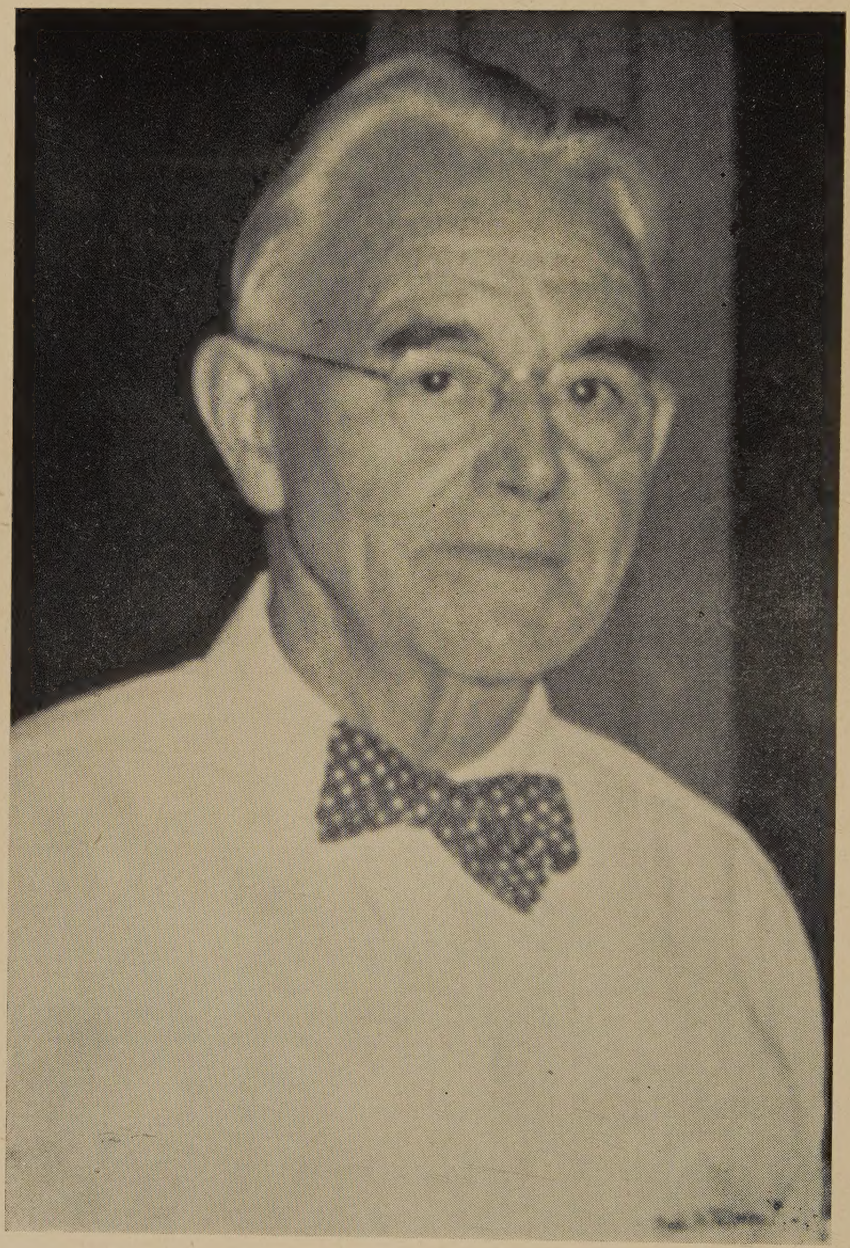

ALPHEUS MANSFIELD GOODMAN

ALPHEUS MANSFIELD GOODMAN

WHEREAS, In the death of Alpheus Mansfield Goodman the agricultural profession has lost a teacher, scientist, citizen, and head of a family; and

WHEREAS, He served with distinction in instructional and administrative positions in various American and foreign agricultural institutions; and

WHEREAS, In the College of Agriculture he laid the groundwork for the implementation of the drainage program at the Central Experiment Station; and

WHEREAS, By his thoughtful understanding of the problems of our farming people and by his friendly way of example he inspired his co-workers to greater dedicated service to the cause of agricultural progress; and

WHEREAS, By his sincere warmth and friendliness he had made himself one with us in our campus life and thereby strengthened and personalized the traditional ties between his country and ours; now therefore be it

RESOLVED, that the faculty of the College of Agriculture of the University of the Philippines express its feeling of grievous loss and extend to his widow and children its expression of deep sympathy; and be it further

RESOLVED, that copies of this resolution be sent to his family and to Cornell University, that they be spread in the minutes of the faculty of the College of Agriculture and sent to the archives of the University, and that they be published in *The Philippine Agriculturist.*

N. DUNGLAO
A. CATAMBAY
T. FLORES
Committee

EXPERIMENTAL TRANSMISSION OF ASPERMY VIRUS TO PHILIPPINE CANNA INDICA [1]

G. O. OCFEMIA [2]

WITH ONE TEXT FIGURE

In transmission experiments involving the aphid vector *Myzus persicae* (Sulzer) and aspermy virus originally obtained from the Nightingale chrysanthemum (*Chrysanthemum morifolium* Ram.), the aphid transmitted the virus from tobacco (*Nicotiana tabacum* L.) to four plants of Philippine *Canna indica* L. among a hundred or more that were tested. The virus had been increased in concentration by three consecutive transfers from tobacco to tobacco before the aphids had had access to it. Very conspicuous symptoms of infection, consisting of greenish white streaks and spots, appeared on one of the canna plants in 26 days (fig. 1A), but only faint and transitory mottling could be seen on the three others.

Subinoculations on tobacco were made by drawing freshly cut edges of the infected *Canna indica* leaves gently over the upper surface of the tobacco leaves, which had been dusted with carborundum No. 320. The first subinoculation was made when conspicuous symptoms had just appeared on the first plant; the second, 23 days later; and the third, after an additional 9 days. The subinoculations resulted in the production of primary lesions in 7 days, 5 days, and 4 days, respectively, thus proving that the observed symptoms on canna were due to the aspermy virus (fig. 1B). Subinoculations from canna to *Nicotiana glutinosa* produced systemic infection in 5 days and caused enations on the upper leaves in 15 days. Subinoculations by means of *Myzus persicae* from each of the three symptomless cannas caused symptoms of aspermy to appear on tobacco seedlings in 5 to 20 days.

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[1] Miscellaneous Contribution No. 32.

[2] Fellow of the John Simon Guggenheim Memorial Foundation from April 15 to December 15, 1955, and concurrently Visiting Investigator at The Rockefeller Institute for Medical Research.

The writer wishes to thank The Rockefeller Institute for Medical Research for facilities kindly provided during this investigation and Dr. F. O. Holmes for courtesies and advice given.

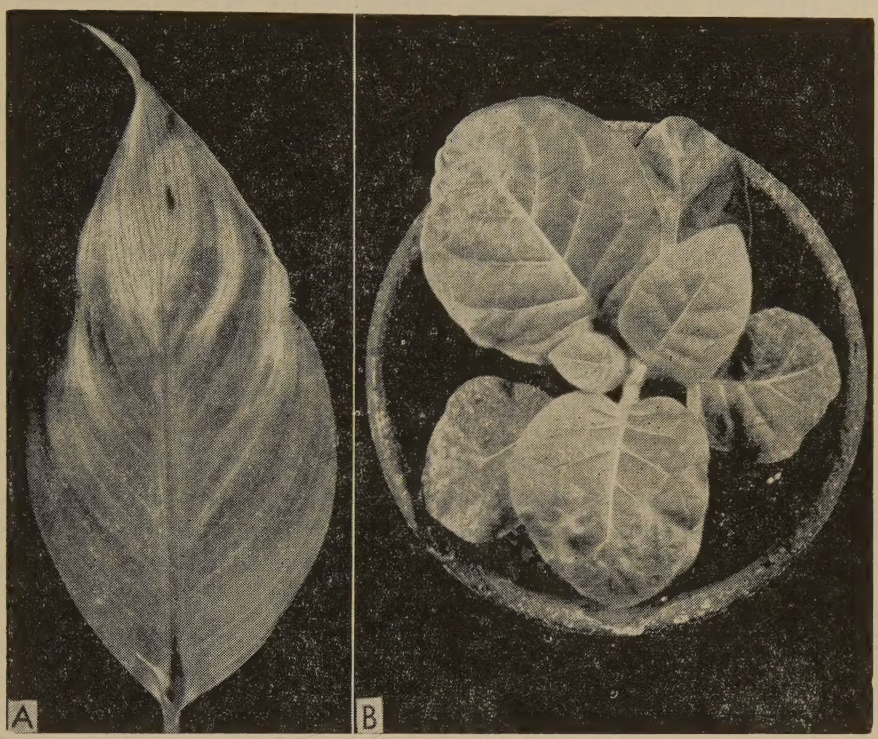

Fig. 1.—A. Mottling caused by aspermy virus on a leaf of *Canna indica;* B. Aspermy on Turkish tobacco caused by subinoculation from the infected *Canna indica.* (*Photographed by J. A. Carlile.*)

A mosaic virus occurring naturally on *Canna indica* in the Philippines is readily transmitted to abacá, *Musa textilis* Née., by *Aphis gossypii* Glover and *A. maidis* Fitch. On abacá it causes a disease resembling, and believed to be identical with, the naturally occurring and destructive abacá mosaic.[3] Experimental transmission of aspermy virus to *Canna indica* by *Myzus persicae* and the nature of symptoms produced suggest that abacá mosaic disease of the Philippines may be caused by a very similar virus or even by some strain of aspermy virus, possibly introduced into the Philippines inadvertently in such a symptomless host plant as the chrysanthemum. Aspermy virus, as known in chrysanthemum, and abacá mosaic virus, as known in *Musa textilis,* have been suspected to be re-

[3] G. O. Ocfemia and M. S. Celino, *Philippine Agriculturist,* 27, 593 (1938).

lated to cucumber mosaic virus. Neither has been fully established as a strain of this virus, however. Their possible relationship to each other needs further study.

The infection of *Canna indica* with aspermy virus records a new monocotyledonous host for the aspermy virus, transmitted by *Myzus persicae* from tobacco to *Canna indica*.

Like thought itself, science has become a passion and a luxury. It follows the gleam, it stirs hopes too wildly dear. It is indeed often not utilitarian enough: science for science's sake is as much a cult as art for art's sake, and can carry one as far from the actualities of purposeful living.

Herbert J. Muller

INFLUENCE OF DIFFERENT APPLICATIONS OF MALEIC HYDRAZIDE ON THE KEEPING QUALITY OF ONIONS [1]

LEODEGARIO M. TABING and L. G. GONZALEZ

WITH ONE TEXT FIGURE

All the concentrations of maleic hydrazide sprayed on onion before harvest completely inhibited sprouting. The sprayed plants had significantly more marketable bulbs after four months in storage: the 2,000-ppm. treatment gave 26.82 per cent; the 2,500-ppm. treatment, 36.33 per cent; the 3,000-ppm. treatment, 30.20 per cent; and the control, 7.82 per cent. Treated bulbs did not show any deviation in color, flavor, and taste from the untreated bulbs.

Increasing reports on the effectiveness of maleic hydrazide preharvest sprays in prolonging storage quality and reducing breakdown of onions raise the question of whether this chemical can be of value under tropical conditions.

Wittwer and Sharma found that among bulbs that had been sprayed with 2,500 parts per million of maleic hydrazide, no sprouting was evident and breakdown significantly decreased.[2] Flavor and color were apparently not affected by the chemical. Johannessen and Oebker stated that preharvest foliar sprays of 0.25 per cent maleic hydrazide applied to Early Yellow Globe Brigham and Yellow Globe onions reduced sprouting in a 16-week storage test at 32° and 40°F.[3]

To test the effect of maleic hydrazide on onions under local conditions, a cultural experiment was conducted in the onion fields of the Central Luzon Agricultural College in Nueva Ecija. Samples of the bulbs sprayed with maleic hydrazide two weeks before harvest were brought to the Department of Agronomy, College of Agriculture, Laguna, for observation and evaluation.

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[1] Central Experiment Station Contribution No. 1883. Based on thesis presented by the senior author for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture. Prepared in the Department of Agronomy under the direction of the junior author.

[2] S. H. Wittwer and R. C. Sharma, *Science*, 112, 597 (1950).

[3] G. Johannessen and N. Oebker, *Cornell University Farm Research*, 17, 12 (1951).

MATERIALS AND METHODS

Onion seeds of the Red Globe variety from the Bureau of Plant Industry were planted in the onion seedbed of the Central Luzon Agricultural College. A week after germination, ammonium phosphate was applied to the seedbed at the rate of 300 kilograms a hectare. A second application of the same amount was made two weeks after the plants had been moved to the field.

The experimental area covering approximately 1,000 square meters was divided into four equal replications, and each was subdivided into four equal plots, one for each treatment. The treatments were randomized. The plants were planted on February 10, 1954, at distances of 20 × 20 centimeters. On March 13, 1954, when the onions were fully established, samples to be harvested were tagged. Fifty plants in a treatment were marked out at random.

The plants were sprayed two weeks before harvest, when two-thirds of the tops were beginning to fall. The maleic hydrazide [4] used was 40 per cent pure, with its wetting agent already in the formulation. The concentrations of maleic hydrazide were 2,000 ppm., 2,500 ppm., and 3,000 ppm. All plots were sprayed with a 2½ gallon Hudson air sprayer [5] at the rate of approximately 100 gallons to an acre. The two outermost rows on the edges of each plot were used as border between concentrations. Spraying was done row by row. The control was sprayed with water alone.

Two weeks after spraying, the 50 tagged bulbs from each treatment were harvested. At the time of harvest most of the tops were down. The plants still green had necks soft enough to be in the stage considered prime for harvesting.

The pulled bulbs were left in the field for one day before they were processed for storage. They were brought to the College of Agriculture, weighed immediately upon arrival, air-dried for three days in an open shed, and then placed at random in two standard-sized slat crates (20 × 16 × 16 inches). Each crate was divided into eight equal compartments with air spaces between of 2½ inches. The crates were held for observation in a laboratory room where the temperature ranged from 27.77°C. to 38.89°C., or an average of 31.38°C., and the humidity ranged from 55 per cent to 84 per cent, or an average of 72.6 per cent.

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[4] Donated by Gregorio Araneta, Inc.

[5] Borrowed from the Maligaya Experiment Station, Muñoz, Nueva Ecija.

Every fifteen days the individual treatments were weighed, after the nonmarketable bulbs had been discarded. Sprouting bulbs were also culled.

RESULTS AND DISCUSSION

Field observations. On April 17, 1954, approximately two-thirds of the onion tops had ripened and had begun to fall over. On April 18, 1954, the plants were sprayed with maleic hydrazide. The tops of treated and untreated plants continued to fall practically at the same time, an indication that the maleic hydrazide concentrations did not harm the vegetative growth of the plants. On May 4, 1954, bulb samples were harvested. The treated and untreated lots did not differ in color, odor, and flavor.

Storage observations. The bulbs in storage were examined every 15 days. All the good bulbs were weighed, and the rotten and sprouted bulbs were discarded. A separate analysis of variance was run on the percentages of good bulbs at the end of the first, second, third, and fourth months. There were marked statistically significant differences each month (table 1). At the end of the first month all maleic hydrazide treatments appeared equally good; however, all later readings suggested that the 2,500 and 3,000 ppm. treatments were superior to the 2,000 ppm. treatment. All maleic hydrazide treatments were distinctly superior to the check in each month (fig. 1).

TABLE 1.—*Mean percentage of marketable bulbs in storage*

TREATMENT	AFTER			
	1 mo.	2 mo.	3 mo.	4 mo.
2,000 ppm.	82.55	51.99	33.70	26.82
2,500	83.80	58.00	39.95	36.33
3,000	83.21	59.17	39.06	30.20
Control	65.56	30.65	15.82	7.82
		(2.00)[a]	(12.50)[a]	(10.00)[a]
LSMD	5.17	9.37	7.03	5.68

[a] Percentage of total number of bulbs that sprouted in storage and was discarded.

There was no instance of sprouting in any of the lots treated with maleic hydrazide, but 14.5 per cent of the onions in the control had sprouted by the end of the third month and 24.5 per cent by the end of the fourth month. If these percentages of sprouted bulbs

Fig. 1.—Onion bulbs after four months: A, control; B. 2,000 ppm. treatment; C, 2,500 ppm.; D, 3,000 ppm. (*Photograph by the Photographic Division.*)

are subtracted from the total percentages of bulbs rendered unmarketable while in storage, it will be obvious that most of the discards were for reasons other than sprouting. The most notable point in this regard is that the maleic hydrazide treatments were of value in holding down damage from other troubles.

The changes in weight from month to month in storage did not reveal any significant trends.

. . . the present state of the world and the fear of an atomic war show that scientific progress without a corresponding moral and political progress may only increase the magnitude of the disaster that misdirected skill may bring about.

Bertrand Russell

THE GRAFT AFFINITY OF TRIPHASIA TRIFOLIA (BURM. F.) P. WILS. WITH FIVE VARIETIES OF CITRUS [1]

REMIGIO C. ALINDADA and L. G. GONZALEZ

Limoncito, *Triphasia trifolia* (Burm. f.) P. Wils., is adapted to many parts of the Philippines where some commercial species of citrus do not thrive well. The object of this work was to determine its intergeneric graft affinity with five commercial kinds of citrus: pummelo, *Citrus grandis* (Linn.) Osbeck; Szinkom mandarin, *C. reticulata* Blanco; Batangas mandarin, *C. reticulata* Blanco; calamondin, *C. mitis* Blanco; and calamandarin, *C. reticulata* × *C. mitis*.

MATERIALS AND METHODS

Forty vigorous limoncito seedlings one to two years old were used as stocks. The same number of citrus seedlings about a year old were used as scions.

The plants were inarched one month after the stocks had been planted in equal parts of ordinary garden soil and compost in pots. The inarched plants were placed in the nursery seedbeds where partial shade and good drainage were available.

When good union seemed to have been effected, the stocks were first notched above the point of union, and the scions, below this point. The cuts were made deeper at weekly intervals until severance was complete at the end of two to three weeks. Some of the leaves were partially pruned to minimize transpiration.

Ten plants of each variety were used in four replications.

RESULTS AND DISCUSSION

Qualitative observations. The leaves of inarches which were cut after 149 days started to turn yellow on the second week and eventually fell off. Then the leafless scions wrinkled and dried up. To allow more time for union, the experimental plants were cut off

[1] Central Experiment Station Contribution No. 1884. Based on thesis presented by the senior author for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, March, 1955. Prepared in the Department of Agronomy under the direction of the junior author.

160 days after inarching. Two to three weeks after cutting, the leaves of Batangas mandarin turned yellow and fell off while the stems gradually dried up. Szinkom mandarin and calamandarin were vigorous for two months. In the third month, they began sending out roots from the cut stem. The roots were removed, but others kept on appearing until the scion gradually dried up. New shoots appeared on the limoncito stock on the death of the scion. In other words, of the five scions tested, only pummelo and calamondin were fairly compatible with the limoncito stock.

Percentage of union. Table 1 shows 93 per cent successful union for calamondin and 77 per cent for pummelo. The percentages for Batangas mandarin, Szinkom mandarin, and calamandarin are misleading because the inarches which were alive 14 days after severance when the observation was made did not stay alive very long.

TABLE 1.—*Percentage of living inarches on limoncito 14 days after cutting*

NUMBER OF TRIAL	PUMMELO	CALAMONDIN	CALAMANDARIN	SZINKOM MANDARIN	BATANGAS MANDARIN	TOTAL
I	45.00	56.79	45.00	45.00	50.77	242.56
II	71.56	90.00	50.77	50.77	45.00	308.10
III	56.79	90.00	56.79	56.79	45.00	305.37
IV	71.56	63.44	90.00	63.44	63.44	351.88
Total	244.91	300.23	242.56	216.00	204.21	1,207.91
Mean	61.22	75.05	60.64	54.00	51.05	
Mean percentage [a]	76.8	93.3	76.0	65.5	60.5	

[a] Differences are not significant.

Height and diameter increase. Observations on increases in height and in diameter of pummelo and calamondin were not conclusive and are not presented here.

It is the Nemesis of the struggle for exactitude by the man of science that it leads him to present a mutilated, merely fractional account of the world as a true and complete picture.

H. S. Jennings

SHIELD BUDDING VALENCIA ORANGE (CITRUS SINENSIS OSBECK) TO FIVE KINDS OF STOCKS [1]

MARIANO U. DE MESA and L. G. GONZALEZ

The life expectancy and yield of Valencia oranges grown in the Philippines are less than those grown in other countries where the sweet orange constitutes the greater bulk of citrus produced. One possible reason for this could be the lack of knowledge about the kinds of stocks used.

Bachelor and Webber stated that not all citrus species and types can be used successfully as rootstocks.[2] The stock and scion must not only be capable of uniting but must be capable of producing long-lived productive trees.

The object of this study was to determine the influence of five kinds of stocks on the rate of growth and development of Valencia orange. The experiment was conducted in the College orchard from August, 1954, to September, 1955.

MATERIALS AND METHODS

Planting materials of China, Shekwasha, Batangas mandarin (*Citrus reticulata* Blanco), calamandarin (*C. mitis* Blanco × *C. reticulata* Blanco), and Szinkom mandarin (*C. reticulata* Blanco) oranges were obtained from the College orchard and the Lipa Citrus Experiment Station.[3] Fifty seedlings of each kind of stock were balled and transferred to nursery rows where they were tended to attain the necessary vigor for budding. The plants were shield budded on November 12, 1954, to healthy, well-developed Valencia orange bud sticks of the current season's growth.

On January 12, 1955, twenty budded plants of comparable vigor from each kind of stock were transplanted to kerosene cans. The plants were placed under partial shade, watered and cultivated, and given 50 grams of ammonium sulfate every two months.

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[1] Central Experiment Station Contribution No. 1885. Based on thesis presented by the senior author for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture. Prepared in the Department of Agronomy under the direction of the junior author.

[2] B. D. Bachelor and H. D. Webber, "The Citrus Industry," University of California Press, Berkeley, 1948, vol. 2, 933 pp.

[3] Thanks are due Superintendent D. Altamirano of the Lipa Experiment Station for supplying the China and Shekwasha stocks and to Mr. Benemirito for identifying the varieties.

On September 1, 1955, the plants were transferred to the new orchard in the College Experiment Station. One hundred holes of $1 \times 1 \times \frac{1}{2}$ meters were dug at distances of 7×7 meters in a triangular layout. The budded plants were planted in these holes on September 5.

The randomized complete block design with five replications was used. Each replication had five rows, and four plants of a variety were planted to a row.

RESULTS AND DISCUSSION

Suitability of stocks to shield budding. In this study, buds that did not grow to a height of 1 inch were not considered successful even if the stock and scion did unite. Out of the 50 budded plants of each kind of stock, the number of successful buds was as follows: Batangas mandarin, 40; calamandarin, 34; China, 33; Shekwasha, 36; and Szinkom mandarin, 38 (table 1).

TABLE 1.—*Percentage of success in budding five different stocks to Valencia orange*

KIND OF STOCK	BUDDING SUCCESS
Batangas mandarin	80
Calamandarin	68
China	65
Shekwasha	72
Szinkom mandarin	76

Galang [4] and de Leon [5] reported that Batangas mandarin and calamandarin were the most congenial stocks for the different commercial species of citrus that they studied. On the other hand, Merino found that calamandarin and Szinkom were better than rough lemon, Batangas mandarin, and Szinbat 28 as stocks for the Batangas mandarin.[6] Lobo found that rough lemon ranked first and calamandarin second in the second year of the experiment in the field.[7]

[4] F. G. Galang, *Philippine Agric. Rev.*, 15, 44 (1922).

[5] J. de Leon, *Dept. Agric. Nat. Res. Pop. Bull.*, 8 (1937).

[6] S. Merino, "The Influence of Five Kinds of Stock on Batangas Mandarin (*Citrus reticulata* Blanco)." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, October, 1954. Unpublished.)

[7] A. Lobo, "The Influence of Five Kinds of Stock on Batangas Mandarin. II. Rate of Growth and Development of One-Year-Old Budded Plants." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1955. Unpublished.)

Size and appearance of the scions after 10 months. The scions on Batangas mandarin and calamandarin stocks did not differ significantly in average height (table 2). The scion on Batangas mandarin, however, was superior to those on China, Shekwasha, and Szinkom mandarin stocks. Batangas mandarin stocks also promoted the greatest number of leaves and the greatest girth. However, in increasing size of girth, Batangas mandarin was not significantly better than calamandarin and Szinkom mandarin. It may be concluded that on the basis of height, number of leaves, and girth of the scions, Batangas mandarin and, possibly, calamandarin are better than all the other varieties tested as stocks.

TABLE 2.—*Influence of 5 kinds of stocks on Valencia orange scions 10 months after budding*

SCION CRITERION	STOCK					SMD 5%
	Batangas mandarin	Calaman-darin	China	Shek-washa	Szinkom mandarin	
Av. height from a fixed base (cm.)	50.02	46.97	36.87	32.95	42.99	6.88
Av. number of leaves	45.15	39.90	35.25	28.65	39.15	4.98
Av. size of girth (cm.)	2.17	2.03	1.84	1.72	1.98	0.20

Pests and diseases. A few leaf miners, *Phyllocnistis citrella* Stainton, attacked the plants during the experiment. Infestation by citrus scab (*Elsinoe fawcetti* Bitancourt) and citrus canker (*Xanthomonas citri* [Hasse] Dowson) caused greater damage. The spread was minimized by Bordeaux mixture sprays. Apparently, Batangas mandarin stocks gave the scions some resistance to scab (table 3).

TABLE 3.—*Reaction to scab disease of Valencia orange scions budded to five different stocks*

KIND OF STOCK	NUMBER OF PLANTS ATTACKED	PERCENTAGE	INTENSITY OF DAMAGE
Batangas mandarin	5	25	Slight
Calamandarin	6	30	Slight
China	10	50	Heavy
Shekwasha	13	65	Heavy
Szinkom mandarin	8	40	Slight

BAGASSE MOLASSES AND PITH MOLASSES FOR BROODING CHICKS [1]

F. M. Fronda and F. L. Cortes

Bagasse molasses and pith molasses may profitably replace cane molasses in rations for brooding chicks. The differences in average final weight of the chicks in the three lots were insignificant. The feed conversion efficiencies of the chicks given the three molasses feeds were practically the same. The chicks fed bagasse molasses had the highest mortality rate of 13.3 per cent, which is, however, still within the normal mortality limits under normal conditions.

Cane molasses, which is produced in large amounts in the Philippines, can be fed profitably to livestock, but very little of it is at present utilized for this purpose. The difficulty of handling it is probably one of the main reasons why cane molasses has not gained the popularity that it has attained in other countries. During the last year or so, sugar cane pith has been used as a carrier of molasses. Powdered sugar cane bagasse has also been tried. How these two molasses feeds compare with cane molasses in feeding value when given to brooding chicks should interest sugar producers.

This study was conducted from June to October, 1955, to compare the feeding values for brooding chicks of rations containing bagasse molasses, pith molasses, and pure cane molasses.

MATERIALS AND METHODS

A total of 135 straight-run day-old New Hampshire chicks from the College flock was used in three trials. Each trial consisted of three lots of 15 chicks each. At the start of the experiment, the chicks were weighed by lots. They were raised in an electrically heated battery brooder during their first six weeks of life. Then they were transferred to unheated rearing cages where they remained until the end of the 10-week test.

Lot I was fed a ration containing 5 per cent cane molasses; lot II, a ration containing 5 per cent bagasse molasses; and lot III,

[1] Central Experiment Station Contribution No. 1886. Research Project No. 693-F of the Department of Animal Husbandry.

a ration containing 5 per cent pith molasses. The ingredients of the rations, all parts by weight, are given in table 1.

TABLE 1.—*Composition of the rations given to the three lots*

INGREDIENT	I	II	III
Rice bran	45	45	45
Ground corn	20	20	20
Fish meal	7.5	7.5	7.5
Copra meal	10	10	10
Soybean oil meal	11.5	11.5	11.5
Cane molasses	5	—	—
Bagasse molasses	—	5	—
Pith molasses	—	—	5
Salt	.5	.5	.5
Aurofac	.5	.5	.5
Total	100.0	100.0	100.0

The molasses feeds were supplied by the Luzon Stevedoring Company, Inc. in Manila. Bagasse molasses feed is more moist and compact than pith molasses feed (table 2). It includes the pith and skin of sugar cane, but it contains less fiber than pith molasses. Pith molasses, on the other hand, is dry and friable. It has more fiber, shorter and finer in texture than that in bagasse molasses.

TABLE 2.—*Proximate analysis of bagasse molasses and pith molasses in per cent*

NUTRIENT	BAGASSE MOLASSES	PITH MOLASSES
Moisture	21.62	17.59
Crude protein	2.77	6.75
Crude fats	0.59	0.58
Carbohydrates	61.47	47.61
Crude fiber	7.97	16.81
Ash	5.58	10.66
Calorific value per 100 grams	268.88	228.27

The mash mixtures were prepared by hand. Each kind of molasses feed was first thoroughly mixed with a small amount of the mash. The rest of the mash was gradually added to the mixture. Two kilograms of ground shells were added to every 100 kilograms of the mash mixture. Two per cent cod liver oil was also added to every 100 kilograms of the mixture when the chicks were confined in the battery brooders.

The ration was given to the birds as dry mash. Fresh drinking water was made accessible at all times during the day. Chopped fresh ipil-ipil (*Leucaena glauca* Linn.) leaves were given to the birds three times a week.

RESULTS AND DISCUSSION

Rate of growth. The average initial weights of the chicks were about the same (table 3). There was no consistency in the average biweekly weights of the chicks from the second week up to the end of the experiment in the three trials. The differences between the lots were insignificant.

TABLE 3.—*Average biweekly weights in grams of New Hampshire chicks in three trials*

AGE	LOT I (5% cane molasses)	LOT II (5% bagasse molasses)	LOT III (5% pith molasses)
1 day	41.3	41.3	41.4
2 weeks	92.3	88.5	87.4
4 weeks	183.7	179.7	191.1
6 weeks	333.1	330.0	304.9
8 weeks	486.7	519.8	480.0
10 weeks	652.7	731.9	668.9

Amount and cost of feed consumed and returns above feed cost. During the 10-week period, the chicks in lot I consumed 97.1 kilograms of feed, those in lot II, 104.6 kilograms, and those in lot III, 107.9 kilograms (table 4). The slightly higher feed consumption

TABLE 4.—*Amount and cost of feed consumed and returns above feed cost*

ITEM	LOT I	LOT II	LOT III
Amount of feed consumed, kilograms	97.10	104.58	107.99
Cost of feed consumed, pesos [a]	25.25	27.20	28.08
Total gain in weight in 10 weeks, kilograms	26.14	26.74	28.24
Amount of feed required to produce a kilogram gain, kilograms	3.72	3.95	3.83
Cost of feed required to produce a kilogram gain, pesos	0.97	1.03	1.00
Weanlings produced, kilograms	28.00	28.60	30.10
Returns from sales of weanlings, pesos [b]	56.00	57.20	60.20
Actual returns above feed cost, pesos	30.75	30.00	32.12

[a] Cost of a kilogram of feed in all lots, ₱0.26. The three molasses feeds were assumed to have the same price per kilogram of ₱0.05.
[b] Price of weanlings, ₱2.00 a kilogram.

in lot III may be attributed to the greater number of chicks left alive in that lot until the end of the study. In spite of the fewer birds in lot II, the consumption was higher than that in lot I. This may be due to the slightly more palatable feed given to lot II than to lot I.

The amount and cost of feed consumed to produce a kilogram gain in weight did not differ markedly in the three lots. The returns from sales of weanlings and actual returns above feed cost were slightly higher in lot III than in lots I and II. Based on the average weight of the birds, feed conversion efficiency, total gain in weight, and returns above feed cost, not one molasses feed proved superior to the other two. Any one of the three products can profitably replace rice bran at the level used in this study.

Mortality. The mortality rates in the three lots differed a little from each other (table 5). Although the mortality rate in lot II, which was fed bagasse molasses, was slightly higher (13.3 per cent) than those in lot I given cane molasses (4.4 per cent) and lot III given pith molasses (0 per cent), the figure is still well within the normal limits of brooding mortality under normal conditions.

TABLE 5.—*Percentage of mortality in the three trials*

ITEM	LOT I	LOT II	LOT III
Number of birds at the start	45	45	45
Number of birds that died	2	6	0
Number of birds at the end	43	39	45
Percentage of mortality	4.44	13.33	0

Wayman stated that the good results obtained with pith molasses feed may be due to the prolongation of the feed intake.[2] The animals eat slowly and throughout the day so that the absorption of the highly soluble nutrients in the molasses is slowed down and a favorable medium for the rumen flora is provided.

[2] O. Wayman, *Hawaii Farm Science*, 4, 2 (1955).

Research is but diligent search which enjoys the high flavor of primitive hunting.

James Harvey

PROGRESS REPORT: SIX YEARS OF HOLSTEIN-RED SINDHI CROSSBREEDING WORK [1]

L. S. Castillo, O. A. Palad, L. L. Clamohoy, L. E. Nazareno, and F. B. Sarao [2]

At birth the Holstein-Red Sindhi crossbred female calves weighed 23.5 kilograms; the Holsteins, 24.6; and the Red Sindhis, 23.3. All the breeds made the biggest gains in weight during the first year. The rate of growth dropped from the second to the fifth year.

The milk production of the daughters was 3.3 times more than that of their dams. The butterfat test of the milk of the crossbreds was 3.94 per cent, and that of the Red Sindhis was 3.90 per cent.

The crossbreds were 28.9 months old at first calving; the Holsteins, 24.5; and the Red Sindhis, 39.3. The calving interval of the crossbreds was 13.7 months; the Holsteins, 19.1; and the Red Sindhis, 16.3. The service periods were 4.3 months for the crossbreds, 7.0 for the Red Sindhis, and 9.9 for the Holsteins. The average gestation periods were 280.9 days for the crossbreds, 277.5 for the Red Sindhis, and 275.8 for the Holsteins.

The annual mortality of the crossbred calves and cows was 4.62 per cent; of the Red Sindhis, 4.51; and of the Holsteins, 18.75.

In June, 1949, Hardie, a Holstein bull, was obtained by the UP College of Agriculture from the late Mr. John D. Hardie of Cainta, Rizal. The crossbreeding program of the College intended to combine the high milk producing ability of the Holsteins and the heat tolerance of the Red Sindhis in a suitable dairy animal for the Philippines was begun in January, 1950. Hardie was used to breed all the Red Sindhi cows of the Dairy Husbandry Division. Thirty-six calves are credited to him and seven to the two Holstein bulls which were later added to the herd.

This report of the progress of the crossbreeding program covers data from the Holstein-Red Sindhi, Red Sindhi, and Holstein herds.

WEIGHTS OF THE ANIMALS

At birth the female Holstein-Red Sindhi crossbreds weighed an average of 23.5 kilograms and were as heavy as the Red Sindhi calves of the same age (table 1). The average weight of a few Hol-

[1] Central Experiment Station Contribution No. 1887. Research Project No. 835. Conducted in the Dairy Husbandry Division of the Department of Animal Husbandry.

[2] The authors acknowledge the help given by Dr. G. W. Trimberger, visiting professor of animal husbandry, in the preparation of this paper.

stein female calves, however, was slightly higher than that of either of the two breeds,[3] although these calves were smaller than those reported by Petersen (1950) to be 40.9 kilograms at birth. In Pakistan, the Red Sindhi female calves weigh 18.2 to 20.5 kilograms according to Joshi and Philipps (1953). The birth weight of Holstein-Sahiwal crossbreds in Hope Farm, Jamaica, British West Indies, is 31.3 kilograms, which is higher than the weight of either the pure Holstein or the 3/4 European type breed (Howe, 1949). The Sindhi-Jersey crossbred females at Beltsville, Maryland, weigh 29.5 kilograms according to Fohrman *et al.* (1953).

TABLE 1.—*Weight of Holstein, Holstein-Red Sindhi, and Red Sindhi females*

AGE	HOLSTEIN		HOLSTEIN-RED SINDHI		RED SINDHI	
	No.	Weight	No.	Weight	No.	Weight
		kg.		*kg.*		*kg.*
At birth	5	24.6	27	23.5	15	23.3
1 year	4	200.0	20	150.5	16	109.6
2 years	4	307.0	21	251.5	18	195.7
3 years	8	405.0	17	294.0	17	244.4
4 years	3 [a]	432.3 [a]	9	341.3	16	268.4
5 years	5	470.0	3	354.0	16	276.3

[a] In the fourth year three of the animals decreased abnormally in weight for reasons unknown. Hence, they were not included in the computation. In the fifth year their condition returned to normal.

The three breeds made tremendous gains during the first year, but the rate of growth dropped from the second to the fifth year. The crossbreds weighed 114.1 kilograms less than the Holstein-Sahiwal crossbreds observed by Howe (1949) at five years of age. This might be because Sahiwals are slightly bigger than Red Sindhis. Fohrman *et al.* (1953) noted that Sindhi-Jersey crossbreds of the same age weighed 472.7 kilograms. They were quite surprised because the Red Sindhis were smaller than the Jerseys and the Jersey dams weighed less than their crossbred daughters.

The faster growth rate in the first year for all the breeds might be attributed to the system of management followed. The calves were kept in the calf barns for better care and were fed whole milk during their first six months. The older animals, on the other hand, were released in the pasture and given concentrates only once a day. The Red Sindhis showed the least growth increase in the first year,

[3] "Breeds" as hereinafter mentioned include the Holstein-Red Sindhi crosses.

indicating that they respond slowly to good feeding. The crossbreds showed better growth, perhaps because of heterosis and their ability to graze as long as the Red Sindhis in the sun, in contrast to the Holsteins which stayed in the shade.

MILK PRODUCTION

Thirteen crossbreds finished 22 lactations, but three of them, Nos. 17, 18, and 25, were not included in the computation because their dams had no production records. The dams produced so little milk that the calves had to be fed additional milk from the pail. Crossbred No. 17 produced 1,030.55 kilograms of milk, No. 18 produced 1,012.80 kilograms (average of two lactations), and No. 25 produced 558.00 kilograms.

The largest increases in production were made by crossbred No. 4 with 1,944.25 kilograms and by No. 12 with 1,875.47 kilograms. On the other hand, the least increases were made by Nos. 6 and 16, both daughters of Red Sindhi No. 11, with 89.02 and 561.62 kilograms, respectively. These wide differences probably reflect the differences in transmitting ability of the dams.

The average milk production of the 10 crossbred daughters based on 18 lactations was 1,729.08 kilograms; that of their dams in 43 lactations was 522.52 kilograms, or a difference of 1,206.56 kilograms (table 2). The increase of 3.3 times over the production of the dams is attributed to the influence of the sire, Hardie.

The response of the dams to upgrading was gauged by grouping them into good and scrub cows. Nos. 1, 10, and 11 were considered

TABLE 2.—*Milk production of daughters and dams*

ITEM	TOTAL	AVERAGE
Holstein-Red Sindhi:		
Number of cows	10	
Number of lactation records	18	
Number of days milked	—	338.5
Milk production, kg.	—	1,729.08
Red Sindhi:		
Number of cows	10	
Number of lactation records	43	
Number of days milked	—	259.3
Milk production, kg.	—	522.52
Difference of milk production, kg.	—	+1,206.56

good cows, and the others composed the scrub group. The average production of the good group was 1,101.52 kilograms, and that of the scrub group was 139.28 kilograms. The corresponding productions of their crossbred daughters were 2,143.45 and 1,449.48 kilograms. The increase in production of the daughters of the good dams was 94.59 per cent, and of those of the scrub dams, 940.70 per cent. The influence of the Holstein blood was less pronounced on the good dams than on the scrub dams. This tremendous increase in production of the crossbreds follows the trend of results reported by Fohrman *et al.* (1953), Harrison (1944), Howe (1949), Rigor and Robles (1949).

The butterfat test of the milk from the crossbreds was 3.94 per cent, and that from the Red Sindhis was 3.90 per cent. According to Joshi and Phillips (1953), milk from Red Sindhi cows in India tested 4.925 per cent.

It is evident that the present Red Sindhi herd of the College is poorer than the one before World War II. Sarao and Manresa (1941) reported the average yield of five College cows in 19 lactations to be 1,366.7 liters, or 1,407.29 kilograms in 300 days. Rigor and Palicte (1949) stated that at the Alabang Stock Farm the average milk production of 30 Red Sindhi cows in 39 lactations was 1,018.58 liters, or 1,049.14 kilograms in 245 days.

Jersey-Red Sindhi crossbreds in India, according to Millen and Bhata (1946), gave 1,946.95 kilograms in 358.8 days. The original Red Sindhi stock from which they descended averaged only 863.63 kilograms and had a much longer calving interval. Warner (1952) found that in 10 lactations of Red Sindhi, the average milk production was 1,945.45 kilograms in 329.2 days.

Harrison (1944) reported the Holstein-Zebu cross to produce 1,961.81 kilograms. Howe (1949) gave the average of 2,502.50 kilograms for the Holstein-Sahiwal in 305 days. He further reported that milk production during a lactation increased as the amount of Zebu blood increased towards the 50 per cent level. In Egypt, Sidky (1950) stated that the Holstein-Egyptian crossbreds produced an average of 1,610.45 kilograms in 38 lactations.

The Holstein-Red Sindhi crossbreds were more persistent than their dams. Their lactation periods ranged from 275 to 441 days with an average of 338.5 days. The lactation periods of the dams ranged from 163.40 to 426 days, averaging 259.3. It is worth mentioning that the crossbreds are easy milkers and the Red Sindhis

are hard milkers. Before milking the Red Sindhis have to be stimulated by the presence of their calves nearby. In some cases the calves were allowed to suck their dams for a few seconds to stimulate the flow of milk. Red Sindhi Nos. 1, 10, and 11 were milked in the absence of their calves. Crossbred calves easily learn to drink milk from the pail.

AGE AT FIRST CALVING

The crossbreds dropped their first calves at the age of 28.9 months, which is 10.4 months earlier than the Red Sindhis but 4.4 months later than the Holsteins. The Holsteins, however, were bred a little bit too early since the age at which they might be bred in temperate countries is 18 months according to Petersen (1950). The early calving of the crossbreds is important for productivity as a late age of first calving invariably affects the total amount of milk produced. Sindhi-Jersey crosses dropped the first calves at 25 months of age (Fohrman *et al.*, 1953); Holstein-Sahiwal crosses in Hope Farm, Jamaica, were delivered at 42 months (Howe, 1949).

The Red Sindhis of the College herd dropped their first calves at 39.3 months, which is slightly earlier than the 44.8 months reported by Warner (1952) and the 40 to 47 months reported by Stonaker *et al.* (1953). However, Sarao and Manresa (1941) reported an earlier age of calving of 35 months, and Rigor (1949a), 36.5 months.

CALVING INTERVAL

Early calving is an advantage in the production of more calves and more total milk. The crossbreds calved oftener than either the Red Sindhis or the Holsteins (table 3). Their calving interval of 13.7 months is shorter than the 14.7 months reported by Fohrman *et al.* (1953), but longer than the 12 months reported by most dairymen. The long calving interval of the Holsteins of 19.1 months is attributed to the failure of three cows to be settled in spite of repeated services.

TABLE 3.—*Age at first calving, calving interval, and length of service period*

	HOLSTEIN		HOLSTEIN-RED SINDHI		RED SINDHI	
	No.	Months	No.	Months	No.	Months
Age at first calving	4	24.5	20	28.9	19	39.3
Calving interval	9	19.1	15	13.7	40	16.3
Length of service period	9	9.9	14	4.3	40	7.0

The calving interval of 16.3 months for the Red Sindhis is within the range of 14 to 18 months between the first and second calvings reported by Stonaker *et al.* (1953) and the 15 to 20 months reported by Joshi and Phillips (1953). On the other hand, Sarao and Manresa (1941) reported an earlier calving of 11.5 months, and Rigor (1949b), 14.9 months.

LENGTH OF GESTATION AND SERVICE PERIODS

The gestation period of the crossbreds ranged from 264 to 309 days, or an average of 280.9 days. The Red Sindhi cows were in calf for 277.5 days, and the Holsteins for 275.8 days. Slightly longer gestation periods of 280 and 287 days for the Red Sindhi cows were reported by Rigor (1949a) and Sarao and Manresa (1941), respectively. There is no tendency for the crossbreds to be carried longer than the Red Sindhis.

The length of the service period is the interval between calving and subsequent conception. This is obtained by subtracting the average gestation period from the average calving interval. The average service period for the crossbreds was 4.3 months; the Red Sindhis, 7.0; and the Holsteins, 9.9 (table 3). Howe (1949) reported 7.0 months as the length of service period for the Holstein-Sahiwal crossbreds. He further observed that cows with a high percentage of Zebu blood were often difficult to get in calf when they were milking and often could not be settled unless they were dried off.

ADAPTABILITY TO LOCAL CONDITIONS

Although the studies of Villegas *et al.*[4] and Tan and Castillo (1955) are not comparable, the results may give an idea of the adaptability of dairy animals. For the Red Sindhi the pulse rate found was 71.4 a minute; respiration rate, 24.1; and body temperature, 38.5°C. For the crossbreds the pulse rate was 86.2; respiration rate, 30.2; and body temperature, 38.7°C.

Gajardo stated that the Red Sindhis seem to be better adapted to local conditions since their hemoglobin index is 10.50 ± 0.11 grams in 100 ml. of blood, whereas that of the crossbreds is 8.68 ± 0.10

[4] V. Villegas, F. S. Mensalvas, and L. S. Castillo, "A Comparative Study of the Pulse Rate, Frequency of Respiration and Body Temperature of Holstein, Jersey, Brown Swiss, Red Sindhi, Sahiwal, Nellore, and Philippine Cows in the Shade and in the Sun." (Read on November 19, 1953, at the 8th Pacific Science Congress.)

grams.[5] Calo reported that Holstein dams have a hemoglobin index of 8.1 ± 0.10 grams in 100 ml. of blood, and their calves, 8.0 ± 0.10.[6] Manresa and Reyes (1934) got almost similar findings in their study of mature Holsteins. Blood studies by Rusoff *et al.* (1953) revealed that hemoglobin and hematocrit values are higher for the Sindhi crosses than for their purebred Brown Swiss, Holstein, or Jersey dams.

Fohrman *et al.* (1953) concluded that, on the average, the resistance to high temperature is greater in the Sindhi-Jersey crossbreds than in Jerseys whether they are compared as heifers, as dry cows, or as cows producing equal quantities of milk.

These studies would seem to indicate that crossbreds are able to adapt to tropical environment and that the Zebu blood has succeeded in imparting the good quality of resistance to high atmospheric temperatures and other climatic factors.

MORTALITY OF THE ANIMALS

The lower the death rate, the more adapted animals are to the environment. The average annual mortality of the crossbred herd in 5.3 years was 4.62 per cent. Of the six animals which died, four were calves. The causes of death were pneumonia, weakness at birth, and anaplasmosis.

The Red Sindhi herd in 8.7 years had an annual average mortality of 4.51 per cent. Of the 12 animals which died, 9 were calves. Causes of death were anaplasmosis, anthrax, dysentery, and bloat.

Hermosura and Laygo (1953) stated that the Sahiwal shipment received by the Alabang Stock Farm in 1950 had an annual cow mortality of 4.61 per cent and a total calf mortality of 13.86 per cent. The Holstein and Jersey cows at the same stock farm died at the rate of 17.24 per cent a year; the total calf mortality of the same breeds was 63.55 per cent.

The College of Agriculture Holstein herd in four years had an average annual mortality of 18.75 per cent for the cows and calves together. Of the 13 animals which died, 5 were calves. Ana-

[5] R. F. Gajardo, "Hematological Studies on Cattle: I. The Hemoglobin Index, Erythrocyte and Leucocyte Counts of the Blood of the Red Sindhi and Holstein-Red Sindhi Crossbred Cattle." (Thesis presented for graduation, 1954. Unpublished.)

[6] L. L. Calo, "A Study of the Pulse Rate, Frequency of Respiration, Body Temperature, Hemoglobin Index, and Blood Cell Counts of Holstein-Friesian Dams and their Daughters." (Thesis presented for graduation, 1954. Unpublished.)

plasmosis took the heaviest toll, followed by hemorrhagic septicemia, contagious abortion, tuberculosis, nephritis, and pneumonia. One three-month-old female calf and her dam were found positive for tuberculosis and contagious abortion. *Ascaris lumbricoides* and *Haemonchus contortus* were the most common parasitic causes of death among the calves of the three breeds.

BREEDING PLAN

The following plan, "Breeding Better Dairy Cattle for the South" (Frye *et al.*, 1954) as revised on March 1, 1954, by the Regional Committee for the Southern States and Puerto Rico, is adopted with modifications as a guide for the College breeding program in the next 20 years or more:

1. Breeding units will be set up to study strains developed from crosses of Holstein-Red Sindhi. In subsequent reports the breed of the sire will be listed first.

2. Foundation females will be selected, insofar as possible, on the basis of productive capacity, heat tolerance, apparent vigor, and freedom from disease.

3. After the first cross, backcrosses to the F_1 parents may be made. The number of backcross generations to be produced will be determined by the results obtained. Backcrossing and purebred matings will be continued until it appears that an apparently optimum combination of parental traits has been obtained.

4. If possible, bulls used for backcrossing will be progeny-tested sires with "superior sire" rating.

5. Backcross progeny will be selected on the basis of productive ability, tolerance to heat, resistance to parasitic infestation, and other factors contributing to the value of the animals for the purpose intended.

6. Selected progeny from the appropriate crosses will be bred *inter se*. So far as possible, bulls used in this and successive stages will be progeny-tested in commercial herds before breeding to females in the experiment.

7. Adequate controls maintained under the same environment and feeding and management conditions will be provided. Where applicable, the P_1 female purebreds remaining after production of the needed crossbred calves will be bred to the same purebred sires used for backcrossing, to produce additional purebred females to be maintained and controlled.

8. Study will be made of measurements of productive capacity, growth rate, heat tolerance, and other factors affecting adaptability and economic value under Philippine conditions.

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THE ECONOMIC AND SOCIAL STATUS OF RICE FARMERS IN THE ILOCOS REGION [1]

FRANCISCO M. SACAY, FELIX R. ANDAY, MAURO O. ORDILLO, and JUAN Y. SOLOMON

This survey shows that the low income and unsatisfactory standard of living of the farm families are due to the small farms and poor methods of farming. The farmers do not raise sufficient livestock and do not follow a more balanced type of farming. To improve the economic and social conditions of these farm families, the various agencies of the government should help the barrio residents learn how to help themselves.

An accurate knowledge of rural conditions is necessary before an effective program of improvement can be implemented by the government. Since rice is the most important agricultural crop of the Philippines, the conditions of the rice-growing population in different regions deserve first attention.

Sacay and Naanep surveyed the farm, home, and community conditions of 136 rural households in a barrio in Ilocos Norte.[2] Mañgasep conducted a socio-economic study of 150 farm households in Dingras, Ilocos Norte.[3]

The investigation reported in this paper included 108 farmers in the barrio of Baoa in Batac, Ilocos Norte; 100 farmers in the barrio of Binacud in Sinait, Ilocos Sur; and 157 farmers in the barrio of Butubut in Balaoan, La Union. Of the 365 farmers, 176 were owner-operators; 144, part-owners; and 45, tenants. The field survey was conducted during the summer months of 1953. The farm business covered the farm year ending May 15, 1953.

DESCRIPTION OF THE AREAS SURVEYED

Baoa is in the northeastern part of Batac, Ilocos Norte. Only one narrow road connects it to the other barrios and to the poblacion about 5 kilometers away. The municipality, however, is traversed by the national road. It has a public rural high school and a private

[1] Central Experiment Station Contribution No. 1888.

[2] F. M. Sacay and F. R. Naanep, *Philippine Agriculturist*, 29, 555 (1940).

[3] T. L. Mañgasep, "A Study of the Economic and Social Conditions of Rice Farmers in Dingras, Ilocos Norte." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1947. (Unpublished.)

high school offering the general curriculum. In addition, it has a private college offering a two-year normal course, a high-school course, and vocational courses. The barrio has an elementary school. It has no irrigation system.

Binacud, which is in Sinait, Ilocos Sur, is about 2.5 kilometers east of the poblacion and about 2.5 kilometers from the national highway. A road along the river connects the barrio to the poblacion and the other barrios. When the water rises during the rainy season, pedestrians use the dike parallel to the river. During the rainy months, the water that is diverted from the river benefits more than 80 per cent of the farmers. The barrio has no store nor chapel but has a school offering complete elementary instruction. The municipality has a public high school which offers academic and vocational courses. The nearest college is in Vigan, 25 kilometers away.

Butubut in the northeastern part of Balaoan, La Union, is 4 kilometers from the poblacion and from the national highway. It has two small stores and an elementary school which is, however, not easily accessible to school children from the northern section. The municipality has one private school and one private college which offers a junior normal course and a four-year education curriculum. An irrigation system waters the fields in the barrio.

ECONOMIC CONDITIONS

Birthplace, age, and farming experience of operators. The average age of farm operators was 47 years (table 1). The owner-operators were somewhat older than the past-owners and tenants.

Over four-fifths of the farm operators were born in the barrio where they were residing. More of the tenants were born in other municipalities, showing that they went to places where they could find farms to operate.

Because tenants were much younger than other operators and were a more mobile class, their length of residence in the barrio was shortest. They also had the shortest farming experience. The number of years that tenants had been operating farms was less than half that of the owner-operators or that of the part-owners.

Size of farms. The farms ranged from 1/10 hectare to more than 4½ hectares (table 2). Farms from 1 to 2 hectares were the most common. The average area was 1.7 hectares. Farms in the Ilocos provinces are much smaller than those in other regions of the Philippines because of the density of population in Ilocos. Frag-

TABLE 1.—*Birthplace, age, and farming experience of operators*

ITEM	OWNER	PART-OWNER	TENANT	ALL FARMERS
Number of farms	176	144	45	365
Age of farm operators, years	48	46	43	47
Birthplace of farm operators in per cent:				
Operator's barrio	85	83	76	83
Other barrios of municipality	10	15	13	12
Other municipalities of province	3	2	9	3
Other provinces	2	0	2	2
Length of residence in barrio, years	45	43	37	43
Length of residence in municipality, years	46	45	39	45
Number of years engaged in farming	29	30	25	29
Number of years farming in barrio	28	28	22	28
Number of years operating farm	22	23	9	21

mentation of farms was minimized to a certain extent by migrations to urban areas or to newly opened agricultural regions.

The owner-operators had the largest farms and the tenants had the smallest.

TABLE 2.—*Size of farms*

AREA IN HECTARES	NUMBER			ALL FARMS	
	Owner	Part-owner	Tenant	Number	Per cent
0.50 and below	10	5	1	16	4
0.51–1.00	25	36	18	79	22
1.01–1.50	39	44	10	93	25
1.51–2.00	46	34	13	93	25
2.01–2.50	23	17	2	42	11
2.51–3.00	20	3	1	24	7
3.01–3.50	4	3	0	7	2
3.51–4.00	3	1	0	4	1
4.01–4.50	3	1	0	4	1
4.51 and over	3	0	0	3	1
Total	176	144	45	365	100 [a]
Average area	1.9	1.5	1.2	1.7	

[a] Rounded.

Utilization of farm area. More than four-fifths of the farm area was planted to crops (table 3). A small area was used as farmstead. The rest was in pasture and forest.

TABLE 3.—*Utilization of farm area in hectares*

USE	OWNER	PART-OWNER	TENANT	ALL FARMS	PER CENT
Crops	1.6	1.3	1.1	1.4	86
Farmstead	0.1	0.1	0.1	0.1	4
Pasture and forest	0.2	0.1	[a]	0.2	10
Total	1.9	1.5	1.2	1.7	100

[a] Less than .1 hectare.

Important crops grown and livestock raised. About three-fourths of the crop area was in rice (table 4). Other important crops grown were corn, cowpea, tobacco, and sugar cane. The most common fruit plants grown were banana and coconut.

TABLE 4.—*Important crops grown*

CROP	NUMBER OF FARMS [a]	AREA PLANTED			ALL FARMS
		Owner	Part-owner	Tenant	
			hectares		
Rice	365	1.3	1.1	1.1	1.2
Corn	185	0.2	0.2	[b]	0.2
Cowpea	224	0.1	0.2	1	0.1
Tobacco	96	[b]	[b]	[b]	[b]
Sugar cane	126	0.1	0.1	1	0.1
Other crops	114	0.1	[b]	[b]	0.1
Banana		11.4	6.5	14.4	9.8
Coconut		10.6	2.5	2.4	6.4
Caimito		0.7	0.9		0.7
Others		0.5	1.3	0.2	0.8

[a] Some areas were double cropped.
[b] Less than .1.

The carabao was the principal work animal (table 5). Some farmers kept cattle for work and for meat.

Capital investment per farm. The capital invested per farm averaged ₱4,281, of which about three-fourths was in land (table 6). The next important items were buildings and work animals. Only very little was invested in productive livestock and equipment.

The capital invested in an owner-operated farm was about the same as that in a farm operated by a part-owner. The investment in a tenant-operated farm was much smaller, largely because of the small size of the farm.

TABLE 5.—*Livestock kept*

LIVESTOCK	NUMBER OF FARMS	NUMBER OF ANIMALS			AVERAGE FOR 365 FARMS
		Owner	Part-owner	Tenant	
Work animals:					
Carabaos	344	1.1	1.2	0.9	1.1
Cattle	79	0.3	0.2	0.1	0.2
Other livestock:					
Carabaos	40	0.2	0.1	0.1	0.1
Cattle	98	0.4	0.7	0.1	0.3
Horses	18	0.1	[a]	0.1	0.1
Swine	324	2.1	2.2	1.4	2.0
Goats	133	1.2	0.6	0.6	0.9
Hens	358	8.3	8.4	4.6	7.9
Other chickens	365	16.3	18.5	11.2	15.7
Sheep	16	[a]	0.2	[a]	0.1
Other poultry	1		[a]		[a]

[a] Less than .1.

TABLE 6.—*Capital investment*

FORM OF CAPITAL	OWNER	PART-OWNER	TENANT	ALL FARMS	PER CENT
Land	₱3,300	₱3,524	₱2,018	₱3,230	75
Buildings	659	398	161	495	12
Tools and equipment	86	73	56	77	2
Work animals	290	304	172	281	7
Other livestock	190	194	99	181	4
Seeds and supplies	16	20	13	17	[a]
Total	₱4,541	₱4,513	₱2,519	₱4,281	100 [b]

[a] Less than 1 per cent.
[b] Rounded.

Not all the capital invested in the farms was owned by the operators. The part-owners owned 65 per cent of the total capital investment and the tenants only 29 per cent (table 7). For all farms, the average capital investment of the operator constituted 80 per cent of the total. This high percentage was due to the relatively large number of owner-operators included in the study.

Farm receipts and expenses. About two-fifths of the total farm receipts came from rice. Sugar cane and corn were the other important sources of receipts. Field crops contributed about two-thirds to the total. The rest came from the sale of livestock and livestock products and of fruits and vegetables. The total farm receipts did not include the products used by the operator's family (table 8).

TABLE 7.—*Ownership of capital invested*

FORM OF CAPITAL	CAPITAL OWNED BY		
	Owner	Part-owner	Tenant
Land	₱3,300	₱1,936	₱221
Buildings	659	398	161
Tools and equipment	86	73	55
Other livestock	191	193	99
Work animals	290	304	172
Seeds and supplies	16	16	12
Total	₱4,541	₱2,920	₱721
Percentage of total investment owned by operator	100	65	29

TABLE 8.—*Farm receipts*

SOURCE OF RECEIPTS	OWNER	PART-OWNER	TENANT	ALL FARMS	PER CENT
Field crops:					
Rice	₱208	₱192	₱218	₱203	43
Corn	50	35	1	38	8
Cowpea	8	4	11	7	1
Mungo	8	1	0	4	1
Tobacco	11	6	9	9	2
Sugar cane	58	29	15	41	9
Cogon	10	2	0	6	1
Other crops	17	1	17	11	2
Fruits and vegetables	44	29	29	36	8
Livestock and livestock products	84	80	50	78	17
Increase in capital	22	52	32	35	8
Total	₱520	₱431	₱382	₱468	100

The owner-operators had the highest farm receipts. The tenants had the lowest mainly because they had the smallest farms.

The farm expenses averaged ₱299, of which nearly one-third was cash expenses (table 9). The tenants and the part-owners had much larger expenses because they had to pay the landlord land rent in the form of a share of the crop.

Labor income and labor earnings. The farm operators had the smallest net incomes, and their labor incomes were either very low or negative (table 10). This was because a large proportion of the farm products was not sold but was used at home. When the

TABLE 9.—*Farm expenses*

KIND OF EXPENSES	OWNER	PART-OWNER	TENANT	ALL FARMS	PER CENT
Landlord's share	₱ 0	₱157	₱192	₱ 86	29
Purchased livestock	14	16	12	15	5
Purchased tools & equipment	4	2	7	3	1
Cash expenses	121	75	66	96	32
Unpaid family labor	55	76	53	63	21
Harvester's share	50	22	27	36	12
Total	₱244	₱349	₱356	₱299	100

TABLE 10.—*Labor income and labor earnings*

ITEM	OWNER	PART-OWNER	TENANT	ALL FARMS
Receipts of farm	₱520	₱432	₱382	₱468
Farm expenses	244	349	356	299
Net farm income	276	83	25	169
Interest at 6% on operator's average investment	272	165	43	202
Labor income	4	—82	—18	—33
Farm privileges	550	457	290	481
Labor earnings	554	374	271	448

value of farm privileges was added to the labor income, the labor earnings averaged ₱448.

Labor earnings were influenced by crop area and yield per hectare. As crop area increased, labor earnings tended to go up. Farmers with higher yields per hectare generally had greater labor earnings.

The labor earnings of owner-operators were much higher than those of part-owners and tenants. The owners sold the most farm products because they had the biggest farms. The tenants' labor earnings were lowest because they had the smallest farms.

Farm privileges. The farm receipts of farm operators were low because a big proportion of the products was used at home. The value of crops, fruits, vegetables, and livestock products used at home amounted to ₱399 on the average. When the rental value of the dwelling was added, the farm privileges amounted to ₱481 (table 11). This amount was slightly larger than the farm receipts.

TABLE 11.—*Farm privileges*

ITEM	OWNER	PART-OWNER	TENANT	ALL FARMS	
				Value	Per cent
Farm crops	₱384	₱314	₱202	₱334	70
Fruits and vegetables	45	34	34	39	8
Livestock and livestock products	27	29	15	26	5
Rental value of dwelling	94	80	39	82	17
Total	₱550	₱457	₱290	₱481	100

The farm privileges of owner-operators were the highest, and those of tenants, the lowest. The tenants had to dispose of a larger proportion of their small production to meet land rent.

Family income. To add to the labor earnings from the farm, the operator engaged in off-farm jobs. Other members of the family also contributed to the family income. Some families received financial aid from their children and from the government as pensions. The total family income amounted to ₱1,325 (table 12). As there were 5.7 persons in the family on the average, the income per individual amounted to ₱217.

TABLE 12.—*Family income and amount available for the family*

ITEM	OWNER	PART-OWNER	TENANT	ALL FARMS
Operator's income:				
From job off farm	₱ 186	₱ 54	₱218	₱ 138
From farm (labor earnings)	554	374	272	448
Earnings of other members of family:				
From farm (charged as expense)	55	76	53	63
From job off farm	400	198	189	294
Other sources of income:				
Pensions, aid from children away from home, etc.	187	69	12	119
Interest earned by operator's investment	232	143	34	173
Total family income	₱1,614	₱914	₱778	₱1,235
Number in household	5.6	5.8	5.7	5.7
Income for each member of family	₱ 290	₱158	₱137	₱ 217

The family income of owner-operators was much higher than that of part-owners and tenants largely because of the bigger area farmed by owner-operators, higher income of other family members, and higher interest returns on investment.

Rice-growing practices. A number of rice varieties were grown. Most farmers used seeds from the previous harvest. A large number of them attempted some kind of seed selection. The seeds were stored in a granary or under the house. Some farmers selected the seeds before planting them in the seedbed.

About two-thirds of the farmers plowed the field once. About one-tenth applied commercial fertilizer; a small number used manure. Only a small proportion of farmers attempted to control pests and diseases. Nearly three-fourths of them rotated their crops.

Nearly all farmers harvested rice with a *yatab.*

Rice was sold in the form of unthreshed palay. Sometimes clean rice was sold, generally direct to consumers.

SOCIAL CONDITIONS

Types of household. The most common household was the husband-wife-children type. The number of individuals in the household ranged from 1 to 15, or an average of 5.7. The number by tenure differed slightly.

More than one-half of the households had resident family members only. About one-third of the households had relatives in addition to the resident family members.

Type, size, and value of dwellings. Only a few dwellings were roofed with galvanized iron sheets. These were owned by owner-operators and part-owners. Almost five-sixths of all the dwellings had cogon roofs. The owner-operators had better houses.

About one-third of the dwellings had cogon roofs, buho walls, and bamboo floors. The next most common type of dwelling had cogon roof, buho and bamboo walls, and bamboo floor. The materials used could be obtained cheaply in the locality.

The average area of dwellings was 50 square meters, or 9 square meters per person. The owner-operators had more floor area per person, and more rooms per dwelling.

The value of the dwellings ranged from less than ₱100 to over ₱4,000 and averaged ₱468. The owner-operators had the most expensive dwellings and the tenants, the least.

Home facilities and conveniences. The farm homes did not have modern facilities and conveniences. Only three homes had phonographs. A fairly good number had wells provided with pumps, some of which were installed in the kitchen.

The most common household facilities were wooden chairs, wooden benches, and bamboo chairs. A large proportion of the farm homes were provided with wooden or bamboo beds. About one-third had sewing machines.

Educational attainment of operators and their children. The average schooling of farm operators was about three grades. Almost one-third did not have any schooling. Less than 4 per cent reached the high school. The owner-operators had slightly higher educational attainment.

Most of the children from 7 to 14 years were attending school. On the other hand, a major proportion of those 15 years old and over were out of school, mainly because of financial lack.

The average schooling of children 7 to 14 years old who were out of school was about three grades.

Reading matter in farm homes. About one-third of the homes did not have reading matter of any kind. The rest had magazines or newspapers. Many families merely borrowed from neighbors.

The most popular magazine was the *Bannawag,* an Ilocano weekly. The *Silaw* ranked next in popularity. Not many homes had newspapers. The most popular was the Ilocano *Naimbag nga Damag.* Very few read English magazines and newspapers.

Recreational activities. The most common recreational activities among parents were chatting and going to parties. About one-third of the operators went to cockfights.

Among the children, going to parties and dances was the most common recreation. They also chatted with neighbors and members of the family and played with other children. Very few engaged in reading as a form of recreation.

Only very few adults went to the moving pictures, primarily because of the distance of movie houses from the barrio. A larger proportion of the children frequented the movie houses.

Membership in organizations. The majority of the families were represented in the Parent-Teacher Association. About one-third were members of the farmers' association. A number of families belonged to the *purok,* an association of residents of a section of the barrio.

Some of the children in school were members of class and student body organizations. A few girls belonged to the Girl Scouts Organization.

THE LOS BAÑOS BIOLOGICAL CLUB PROCEEDINGS
1955–1956

Professor Eugenio de la Cruz, the incumbent president of the Club, started each meeting by announcing the papers to be presented.

There were eight meetings during the year, held every last Friday of the month. There were no meetings in December and March because the last Fridays of these months occurred during vacation periods.

The following are the abstracts of the papers and excerpts from the discussions:

1. The degree of susceptibility to staining fungus of unscraped rattan poles leached in running water at different lengths of time. By Professor E. F. Roldan, College of Forestry, U.P.

The study was premised on the fact that submergence in running water leaches out the stored food in rattan poles. The fungi would in that way be deprived of food for their growth.

Poles selected for soundness and uniformity were bundled into lots of five pieces each. They were submerged in a pool of warm water at Pansol Spring. Two bundles were taken out at two-week intervals. The first pair was removed two weeks after submersion, and the last one, twelve weeks later. The poles were allowed to dry in the shade, scraped, and examined for stain infection two months after removal.

Submersion rendered some of the freshly cut poles free from infection by staining fungi (*Ceratostomella* and *Diplodia*) but failed to provide 100 per cent protection. Infection ranged from 70 per cent in the lots submerged for two weeks to 20 per cent in those submerged for twelve weeks. Fungus growth on rattan-agar culture media was most dense on rattan samples submerged for two weeks and very sparse on samples submerged for twelve weeks.

PROF. HUNT: In commercial practice where does staining take place? Will submergence be practicable, or would treatment with fungicide be preferable?

PROF. ROLDAN: Staining proceeds from cutting to storage . . . One rattan dealer in Davao uses Dowicide dip intensively.

MR. MONSALUD: How about the quality? Is the rattan still good for export?

PROF. ROLDAN: I do not know if it will pass the standard. We have not made any test on strength.

PROF. CEDILLO: Have you tried submerging in salt water?

DEAN MABESA: Salt in rattan is objectionable because it will corrode nails used later in the manufacture of articles.

2a. Experimental studies for the control of Sapinit (Lantana camara L.) with different herbicides. By Mr. Gregorio C. Lugod, College of Agriculture, U. P.

For the purpose of finding an economical way of reclaiming wasteland overrun by this weed, various concentrations of different herbicides (Dow Esteron, 2,4,5-T, Dow 2,4,5-T Amine, Dow Esteron 245, Weedone Brush-killer 64, Ammate and Weedone LV-4) were applied as foliage spray, basal spray, stump spray, and regrowth spray.

As a foliage spray, Dow Esteron 2,4,5-T at 4 pounds per gallon of aqueous solution was the best. Dow Esteron 245 at 2 pounds per 100 gallons of oil emulsion was best as a basal spray. Weedone Brush-killer 64 at 8 pounds per 100 gallons of oil emulsion (diesel oil No. 2) was a good stump spray.

MR. SANTA MARIA: Is it economical to control Lantana with these chemicals?

DR. FERTIG: One important consideration is that the chemicals usually kill the roots; hence, regrowth seldom occurs. On the other hand, cutting the plant down seems to induce sprouts to come out of the stump. And worse, when cutting is done in the rainy season, the twig that falls on moist ground takes root and becomes a new plant.

2b. The inhibiting effect of maleic hydrazide (MH-40) on the growth of lawn grasses. By Dr. S. N. Fertig and Mr. M. R. Vega, College of Agriculture, U. P.

This was an attempt to find a more economical way of keeping lawn grasses in trim. Aqueous solutions of maleic hydrazide ranging from 0.25 per cent to 2 per cent were sprayed on a mixed lawn at the rates of 500 and 1,000 liters per hectare at different times of the year. Periodic clippings were made to determine the amount of growth after spraying.

Spraying with 0.5 per cent maleic hydrazide on June 11, 1953, at the start of the rainy season, resulted in a markedly inhibited growth.

The trial on August 7, 1954, during the height of the rainy season, showed that 103 days after spraying, the fresh weights of clippings from the lots treated with either 0.5 or 1.0 per cent maleic hyrazide were only one-half of those from the untreated lots. Although there was no growth in the lot sprayed with 2.0 per cent MH-40, this concentration cannot be recommended because it results in discoloration and drying of the leaves.

Results of spraying on November 18, 1954, toward the close of the rainy season showed that the lot sprayed with 0.5 per cent maleic hydrazide at 500 liters per hectare had the least regrowth 40 and 60 days after spraying.

The experiment on February 2, 1955, during the dry season, was not followed up because towards March and April all the lots turned brown. There was no need to check the growth of grasses when the protracted dry weather was so apparently unfavorable to growth.

MR. MONSALUD: How does maleic hydrazide act on the plant? Does it destroy the leaves that it gets in contact with?

MR. VEGA: It is reported to inhibit meristematic activity.

DR. CARAÑGAL: Does maleic hydrazide destroy chlorophyll to make anthocyanin show up?

DR. FERTIG: Apparently there is no such relationship between chlorophyll and anthocyanin. The latter is formed whenever sugars accumulate in the leaves.

3. Seasons and prices. By Prof. Andres D. Goseco, College of Agriculture, U.P.

The effect of prices on human activity was stressed. Prices determine the course of production on one hand and the course of consumption on the other. The year-round survey and the long term trends of prices of chicken eggs, coconuts, cabbage, gabi, potatoes, ginger, tomatoes, lumber, red corn, Elon-elon rice, palay, chicken, pork, laundry soap, evaporated milk, West Point Khaki, vegetable lard, men's shoes, Vick's Vaporub, Manila hemp, copra, and sugar seemed to justify the following tentative deductions:

a. There is a remarkable relation between production and seasonal price fluctuations. This relation is sometimes obscured by out-

side factors like tariff, importation, government storage, or price-support programs.

b. Price margins between the season's peak and bottom periods tend to be wider for perishable than for nonperishable items.

c. Prices tend to behave more violently for unprocessed than for processed commodities.

d. Prices of export crops depend mainly on market movements abroad. They do not follow the high production-low prices: low production-low prices concept.

e. The data emphasized that price-making factors operate rather simultaneously, and each price-making force operates on a scale which varies in intensity and magnitude, depending on the commodity, time, place, and person involved.

DR. CENDAÑA: What do you mean by index of prices?

PROF. GOSECO: It is the prices of the commodity during the year converted into a relative unit, the average for the year being taken as 100.

PROF. HUNT: If the index is based on the average for six years, what value is it to a consumer of today? It may be entirely misleading.

MR. RECTO: If housewives take the cycle and buy at low, what will happen to your cycle?

DR. KEARL: It will take a lot of housewives acting together to change the cycle, and there are not many housewives who are that wise.

4a. Comparative palatability of soilages for horses. By Dr. Valente Villegas, College of Agriculture, U.P.

Corn forage, *timsim-timsiman, buñgalon,* Bermuda grass, and *culape* were found to be more palatable than Para grass for horses. *Barit, paraguis,* and *trigo-trigohan* were equal to Para grass in palatability. *Aguiñgay, Centrosema pubescens* Benth., *carirawraw,* tropical kudzu, Alabang X, *batad-batadan, bulang, ipil-ipil, Pennisetum setosum* (Swartz) L. Rich., *talahib, luya-luya, camo-camotehan,* and cowpea were consumed in smaller amounts than Para grass.

DR. TURK: I am not clear about the procedure. Did you give the animal the pair of roughages together? Did you use the same manger?

DR. VILLEGAS: Yes, the same manger. The feeds were given in excess.

DR. GALVEZ: I noticed that you reckoned consumption in fresh weight of the grass. This may be complicated by the fluctuation in succulence. How about reckoning consumption in terms of dry matter?

DR. VILLEGAS: It is hard to reckon it in dry matter.

4b. The capacity of Berkjala hogs for concentrate and soilage. By Dr. Valente Villegas.

The amounts of slop and soilage consumed by nine mature Berkjala swine, one male and eight females, were determined. The hogs had an average weight of 177 kilograms.

The mean consumption of slop was 9.8 ± 0.218 kilograms per head a day; of dry concentrate contained in the slop, 3.1 ± 0.07 kilograms; and of soilage in the form of sweet potato vines, 2.1 ± 0.051 kilograms. The percentage consumptions based on the live weight of the hogs were 5.6 ± 0.41 slop, 1.8 ± 0.14 dry concentrate, and 1.2 ± 0.12 soilage.

DR. FRONDA: In the record of soilage consumption from the beginning to the end of the experiment, did you notice a decreasing trend? The animals may eat less of the soilage when the vine is mature.

DR. VILLEGAS: We have a continuously good supply of camote vines from which to select soilage feeds of practically the same age.

5. Current researches in animal husbandry. By Dr. K. L. Turk, College of Agriculture, U.P.

The experiments in the Department of Animal Husbandry in which the writer had participated were reviewed comprehensively.

Under the general heading of "Improvement through breeding of beef cattle and dairy cattle for the Philippines" were included reports of studies on the crosses between Santa Gertrudis and Native and between Brahma and Native for beef cattle; Brown Swiss (or Holstein) × Sahiwal (and or Red Sindhi) and Brown Swiss × Native for dairy cattle. Heat tolerance studies were made to determine how well imported breeds could withstand the Philippine climate.

Dr. Turk spoke of artificial insemination as an important and promising technique in animal improvement. Good quality semen can be imported at a nominal cost and suffices for several cows. This

technique is an economical alternative to importing breeding bulls which may not be adapted here or may inadvertently carry diseases into the country.

The studies on the nutritive value of different feeds and rations for livestock were subdivided into a study of the feed value of corn gluten for dairy cattle, a study of the value of cane molasses in livestock rations, and studies on the feeding value of forages.

DR. CARAÑGAL: Studies in other countries show that urea and ammoniated molasses are very good for cattle.

DR. TURK: Good, but why import urea when you have copra meal and corn gluten?

6. Impressions on science and scientists abroad. By Dean L. B. Uichanco, College of Agriculture, U. P.

This was a report of Dean Uichanco on his recent trip to Europe and America. Most of his time was spent traveling, but the little time he had for visits to laboratories and conversations with scientists was spent most profitably. He was much impressed by the work of the "Consejo Superior de Investigaciones Cientificas" in his field of entomology and in botany and soils. He mentioned the rapid progress of science abroad and the frequent inclusion of basic (not to say fundamental) studies even in what is patently applied research.

He observed that the United States is much ahead of any other country in making available to the public the products of her research institutions. This is done through a very efficient and advanced system of extension work.

Dean Uichanco spoke glowingly of the warm and hearty reception tendered him at Cornell. To him, arriving at Cornell was just like coming to a second home.

The lively talk was supplemented by colored slides which showed the delicate touch of an artist.

7. Results of experiments on plant disease control. By Dr. A. G. Newhall, College of Agriculture, U. P.

The paper was a restatement of his purpose and function in the College as a visiting professor and a preview of the results of his extensive experiments.

Dr. Newhall was of the opinion that in a state-supported institution, the emphasis of instruction should be on the practical, utili-

tarian, and economic aspects. In his particular field of plant pathology, he paid attention to the training of students in its application. This he did by directing research activities of senior students, graduate students, and junior staff members. His research activities ranged from introduction of coffee varieties for resistance to coffee rust to control by chemicals of different diseases of coffee, citrus, kenaf, tobacco, etc. and seed and soil treatments for the control of seed- and soil-borne diseases.

8. Exploratory studies on the mechanical and physical properties of some Philippine woods. By Prof. Rosario Cortez and Mr. Francisco Manuel, Forest Products Laboratory.

The first part of the paper described the Forest Products Laboratory, its objectives and functions.

The material for the study was a 41-year-old Large Leaf Mahogany tree grown in the College of Forestry campus from a seed obtained from the Royal Botanic Garden, Sibpur, Calcutta, India. Its d.b.h. (diameter at breast height) at cutting was 27.9 inches, and its height, 76 feet and 8 inches. The physical properties studied were specific gravity and moisture content. The mechanical properties studied were static bending, compression parallel and perpendicular to grain, hardness and shearing strength along the grain. The values of these properties were compared with published figures for American Large Leaf Mahogany and other species in the Philippines and in the United States.

DEAN MABESA: The figures may need rechecking. That *lumbayao* is harder than *supa* seems unbelievable. Please refer to Espinosa's work.

DEAN SANTOS: Could it be possible that age influences hardness?

DEAN MABESA: Yes, and it is also influenced by locality. Bicol *tañguile* is hard, but Romblon *tañguile* is harder.

DEAN UICHANCO: Casuarina in semidesert Australia is hard, but in the Philippines it is relatively soft.

PROF. DE LA CRUZ: Rate of growth is an important consideration. In a distinct dry-and-wet climate, tree growth is periodically checked and this process results in a hard wood. In places of continuous rain growth is unhampered and soft wood is produced.

DR. FRONDA: When do you harvest mahogany?

PROF. CORTEZ: In the Philippines, it may be harvested at a d.b.h. of 50 centimeters.

DEAN MABESA: The cutting size depends upon the species. In Hopea, you will get a hollow center if you cut a tree beyond a d.b.h. of 50 centimeters.

J. R. VELASCO
Secretary

Scientific laws are not chips off the old block Reality; as interpretations of sense impressions, they take after the human mind as well.

Herbert J. Muller

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